

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appln. No. : 10/017,207 Confirmation No.: 1184
Appellant : MICHAEL L. FRANK
Filed : DECEMBER 13, 2001
TC/A.U. : 2616
Examiner : JAGANNATHAN, M.

Docket No. : 10011303-1
Customer No. : 28390

Title : DUPLEXER WITH A DIFFERENTIAL
RECEIVER PORT IMPLEMENTED
USING ACOUSTIC RESONATOR
ELEMENTS

APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

Dear Sir:

Please consider Appellant's appeal brief as follows:

TABLE OF CONTENTS

1.	Real Party in Interest	3
2.	Related Appeals and Interferences	4
3.	Status of Claims	5
4.	Status of Amendments	6
5.	Summary of Claimed Subject Matter.	7
6.	Grounds of Rejection to be Reviewed on Appeal	9
7.	Arguments	10
8.	Summary	16
9.	Claims Appendix	17
10.	Evidence Appendix	23
11.	Related Proceedings Appendix	23

1. REAL PARTY IN INTEREST

The real party in interest is Assignee Avago Technologies, Inc., a corporation having an office and a place of business at 350 West Trimble Road, San Jose, California 95131.

2. RELATED APPEALS AND INTERFERENCES

Appellant and the undersigned attorneys are not aware of any appeals, judicial proceedings, or any interferences which may be related to, directly affect or be directly affected by, or have a bearing on the Board's decision in the pending appeal.

3. STATUS OF CLAIMS

Claims 1-22 are pending.

Claims 1-7, 9-13, 15-20, and 22 were rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Pub. No. 20030060170 to Tikka, *et al.* (the *Tikka* application).

Claims 8, 14, and 21 were rejected under 35 U.S.C. §103(a) as being unpatentable over the *Tikka* application in view of U.S. Patent No. 5,818,385 to Bartholomew (the *Bartholomew* patent).

Claims 1-22 are the claims on appeal. *See* Appendix.

4. STATUS OF AMENDMENTS

No amendments to the claims were filed subsequent to claims filed on September 26, 2006, in the response to the final rejection.

5. SUMMARY OF CLAIMED SUBJECT MATTER

In this Summary of Claimed Subject Matter, all citations are to the specification of United States Patent Application 10/017,207. All citations are illustrative only and additional support for the cited element may be found elsewhere in the specification. *See generally* FIG. 1.

Independent Claim 1:

A duplexer 10 comprising:

an input/output line 11;

a transmit segment 14, 17 connected to the input/output line 11; and,

a receive segment, the receive segment including:

a balun 15 including:

a first output 31,

a second output 32,

a first transmission line 18 coupled between the input/output line 11 and the first output 31, and

a second transmission line 19 coupled between the input/output line 11 and the second output 32, and

a differential filter 16 connected to the first output 31 and the second output 32, the differential filter 16 including resonator elements (*See* FIGS. 3-5) connected so that at transmit band frequencies of the duplexer, the first output 31 and the second output 32 are shorted.

Independent Claim 11:

A method for providing filtering within a duplexer 10, the method comprising the following steps:

(a) for signals at the transmit band frequencies, performing the following substeps:

(a.1) providing passband transmission through a single-ended filter 17 of the duplexer 10, and

(a.2) providing a short circuit at a first input 31 and second input 32 of a differential filter 16, the first input 31 of the differential filter 16 being connected to an input/output line 11 of the duplexer 10 via a balun 15 and the second input 32 of the differential filter 10 being connected to the input/output line 11 of the duplexer 10 via the balun 15; and,

(b) for signals at the receive band frequencies, performing the following substep:

(b.1) providing passband transmission through the differential filter 16 of the duplexer 10.

Independent Claim 16:

A duplexer 10 comprising:

an input/output line 11;

a transmit segment 14, 17; connected to the input/output line 11; and,

a receive segment, the receive segment including:

a balun 15 connected to the input/output line, the balun 15 including:

a first output 31, and

a second output 32, and

a differential filter 16 connected to the first output 31 and the second output 32, the differential filter 16 shorting the first output 31 and the second output 32 at transmit band frequencies of the duplexer 10.

6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether claims 1-7, 9-13, 15-20, and 22 are anticipated under 35 U.S.C. §102(e) by U.S. Pub. No. 20030060170 to Tikka, *et al.* (the *Tikka* application).

Whether claims 8, 14, and 21 are unpatentable over the *Tikka* application in view of U.S. Patent No. 5,818,385 to Bartholomew (the *Bartholomew* patent).

7. ARGUMENTS

35 U.S.C. §102 Rejections

The Appellant submits that claims 1-7, 9-13, 15-20, and 22 are allowable over the *Tikka* application under 35 U.S.C. §102(e), and that the rejection of claims 1-7, 9-13, 15-20, and 22 should be reversed. The cited reference fails to teach or suggest all the claim limitations.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the . . . claim. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). Thus, to warrant the §102(e) rejection, the references cited by the Examiner must show each and every limitation of the claims in complete detail.

The Appellant asserts that the *Tikka* application fails to teach or suggest all the claim limitations. The *Tikka* application fails to disclose, teach, or suggest:

a duplexer comprising:

an input/output line;

a transmit segment connected to the input/output line; and,

a receive segment, the receive segment including:

a balun including: a first output, a second output, a first transmission line coupled between the input/output line and the first output, and a second transmission line coupled between the input/output line and the second output, and

a differential filter connected to the first output and the second output, the differential filter including resonator elements connected so that at transmit band frequencies of the duplexer, the first output and the second output are shorted, as recited in independent claim 1;

a method for providing filtering within a duplexer, the method comprising the following steps:

(a) for signals at the transmit band frequencies, performing the following substeps: (a.1) providing passband transmission through a single-ended filter of the duplexer, and (a.2) providing a short circuit at a first input and second input of a differential filter, the first input of the differential filter being connected to an input/output line of the duplexer via a balun and the second input of the differential filter being connected to the input/output line of the duplexer via the balun; and,

(b) for signals at the receive band frequencies, performing the following substep: (b.1) providing passband transmission through the differential filter of the duplexer, as recited in independent claim 11; or

a duplexer comprising:

an input/output line;

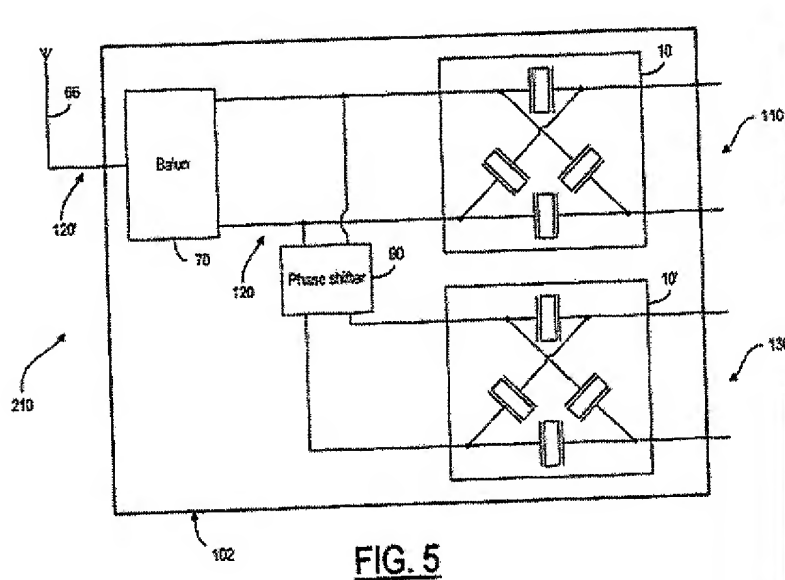
a transmit segment; connected to the input/output line; and,

a receive segment, the receive segment including:

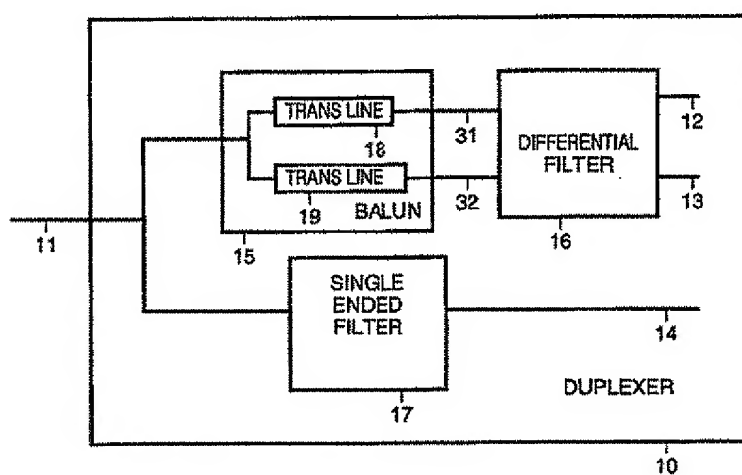
a balun connected to the input/output line, the balun including: a first output, and a second output, and

a differential filter connected to the first output and the second output, the differential filter shorting the first output and the second output at transmit band frequencies of the duplexer, as recited in independent claim 16.

In the Response to Arguments of the Final Office Action dated July 26, 2006, the Examiner mistakenly asserted for claims 1 and 16 that transceiver 110 is connected to second port 120' to establish a separate transmit segment in the *Tikka* application. The Appellant respectfully disagrees. As seen below for Fig. 5 of the *Tikka* application, the balun 70 is common to the first signal path from the transceiver 110 to the second port 120' and the second signal path from transceiver 130 to the second port 120'. Only the balun 70 is connected to port 120'.



This contrasts with the Appellant's invention as claimed and as shown in Figure 1 below, in which the balun 15 is part of the receive segment between input/output 11 of the duplexer 10 and the output 12 and output 13 of differential filter 16. The balun 15 is part of the receive segment alone.



Therefore, the *Tikka* application fails to disclose a transmit segment connected to the input/output line as recited in independent claims 1 and 16.

In the Response to Arguments of the Final Office Action dated July 26, 2006, the Examiner mistakenly asserted for claims 1 and 11 that passband filters 10 and 10' have different passband frequencies in the *Tikka* application, so that passband filter 10 can short signals from the balun 70 preventing output of signals from filter 10 to the transceiver 110. The Appellant disagrees that this is pertinent to the Appellant's invention as claimed. The Appellant claims the differential filter shorting the first output and the second output at transmit band frequencies of the duplexer. If the differential filters 10 and 10' of the *Tikka* application provide a short circuit, the duplexer 102 will no longer be a duplexer, because it will be unable to transmit a signal. While the *Tikka* application contemplates at paragraph [0038] a filtering system that only receives signals, this would not be the duplexer of the Appellant's invention which must both transmit and receive signals.

Regarding claim 11, the Appellant notes that the *Tikka* application fails to disclose a single-ended filter as claimed. All the filters of the *Tikka* application are differential filters. See Figures 2-6. Further, the *Tikka* application teaches away from a single-ended filter and stresses the better electrical performance of a balanced filter over a single-ended filter. See paragraph [0004].

Claims 2-7 and 9-10; claims 12-13 and 15; and claims 17-20 and 22 depend directly or indirectly from independent claims 1, 11, and 16, respectively, and so include all the elements and limitations of their respective independent claims. The Appellant therefore respectfully submits that the dependent claims are allowable over the *Tikka* application for at least the same reasons as set forth above with respect to their respective independent claims.

Reversal of the rejection of claims 1-7, 9-13, 15-20, and 22 under 35 U.S.C. §102(e) as being anticipated by the *Tikka* application is respectfully requested.

35 U.S.C. §103 Rejections

The Appellant submits that claims 8, 14, and 21 are allowable over the *Tikka* application in view of U.S. Patent No. 5,818,385 to Bartholomew (the *Bartholomew* patent) under 35 U.S.C. §103(a), and that the rejection of claims 8, 14, and 21 should be reversed. The cited references fail to teach or suggest all the claim limitations.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art references when combined must teach or suggest all the claim limitations. *See* MPEP 2143. To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). *See* MPEP 2143.03.

The Appellant asserts that the *Tikka* application and the *Bartholomew* patent, alone or in combination, fail to teach or suggest all the claim limitations. As discussed above regarding the rejection under §102, the *Tikka* application fail to disclose, teach, or suggest:

a duplexer comprising:

an input/output line;

a transmit segment connected to the input/output line; and,

a receive segment, the receive segment including:

a balun including: a first output, a second output, a first transmission line coupled between the input/output line and the first output, and a second transmission line coupled between the input/output line and the second output, and

a differential filter connected to the first output and the second output, the differential filter including resonator elements connected so that at transmit band frequencies of the duplexer, the first output and the second output are shorted, as recited in independent claim 1;

a method for providing filtering within a duplexer, the method comprising the following steps:

(a) for signals at the transmit band frequencies, performing the following substeps: (a.1) providing passband transmission through a single-

ended filter of the duplexer, and (a.2) providing a short circuit at a first input and second input of a differential filter, the first input of the differential filter being connected to an input/output line of the duplexer via a balun and the second input of the differential filter being connected to the input/output line of the duplexer via the balun; and,

(b) for signals at the receive band frequencies, performing the following substep: (b.1) providing passband transmission through the differential filter of the duplexer, as recited in independent claim 11; or

a duplexer comprising:

an input/output line;

a transmit segment; connected to the input/output line; and,

a receive segment, the receive segment including:

a balun connected to the input/output line, the balun including: a first output, and a second output, and

a differential filter connected to the first output and the second output, the differential filter shorting the first output and the second output at transmit band frequencies of the duplexer, as recited in independent claim 16.

The *Bartholomew* patent also fails to disclose, teach or suggest these elements. Claims 8, 14, and 21 depend directly from independent claims 1, 11, and 16, respectively, and so include all the elements and limitations of their respective independent claims. The Appellant therefore submits that dependent claims 8, 14, and 21 are allowable over the *Tikka* application in light of the *Bartholomew* patent for at least the same reasons as set forth above with respect to their respective independent claims.

Reversal of the rejection of claims 8, 14, and 21 under 35 U.S.C. §103(a) as being unpatentable over the *Tikka* application in view of the *Bartholomew* patent is respectfully requested.

8. SUMMARY

The Appellant respectfully submits that claims 1-22 fully satisfy the requirements of 35 U.S.C. §§102, 103, and 112. In view of the foregoing, reversal of the rejection of claims 1-22 is respectfully requested.

Dated: November 27, 2006

Respectfully submitted,

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9. CLAIMS APPENDIX

1. A duplexer comprising:
an input/output line;
a transmit segment connected to the input/output line; and,
a receive segment, the receive segment including:
a balun including:
a first output,
a second output,
a first transmission line coupled between the
input/output line and the first output, and
a second transmission line coupled between the
input/output line and the second output, and
a differential filter connected to the first output and the
second output, the differential filter including resonator elements
connected so that at transmit band frequencies of the duplexer, the first
output and the second output are shorted.
2. A duplexer as in claim 1 wherein at transmit band frequencies
of the duplexer, the first output and the second output are each shorted
to a reference voltage.
3. A duplexer as in claim 1 wherein at transmit band frequencies
of the duplexer, the first output and the second output are shorted to
each other.
4. A duplexer as in claim 1 wherein the resonator elements are
arranged so that the differential filter includes resonator elements
arranged in a paired half ladder structure.

5. A duplexer as in claim 1 wherein the resonator elements are arranged so that the differential filter includes resonator elements arranged in a full ladder structure.
6. A duplexer as in claim 1 wherein the resonator elements are arranged so that the differential filter includes resonator elements arranged in a lattice structure.
7. A duplexer as in claim 1 wherein the resonator elements are arranged so that the differential filter includes resonator elements arranged in both a paired half ladder structure and a full ladder structure.
8. A duplexer as in claim 1 wherein a length of the first transmission line is chosen to cause a phase delay of approximately one fourth wave length at receive band frequencies of the duplexer, and a length of the second transmission line is chosen to cause a phase delay of approximately three fourths wave length at the receive band frequencies of the duplexer.
9. A duplexer as in claim 1 wherein the transmit segment includes a single ended filter including resonator elements connected so that at receive band frequencies of the duplexer, an open circuit is presented by the single ended filter to the input/output line.
10. A duplexer as in claim 1 wherein the resonator elements are each implemented as a film bulk acoustic resonator (FBAR).

11. A method for providing filtering within a duplexer, the method comprising the following steps:

(a) for signals at the transmit band frequencies, performing the following substeps:

(a.1) providing passband transmission through a single-ended filter of the duplexer, and

(a.2) providing a short circuit at a first input and second input of a differential filter, the first input of the differential filter being connected to an input/output line of the duplexer via a balun and the second input of the differential filter being connected to the input/output line of the duplexer via the balun; and,

(b) for signals at the receive band frequencies, performing the following substep:

(b.1) providing passband transmission through the differential filter of the duplexer.

12. A method as in claim 11 wherein substep (a.2) includes at transmit band frequencies of the duplexer, shorting the first output and the second output to a reference voltage.

13. A method as in claim 11 wherein substep (a.2) includes at transmit band frequencies of the duplexer, shorting the first output and the second output to each other.

14. A method as in claim 11 wherein step (b) additionally includes the following substeps performed for signals at the receive band frequencies:

(b.2) providing a phase delay of approximately one fourth wave length through a first transmission line within the balun, and

(b.3) providing a phase delay of approximately three fourths wave length through a second transmission line within the balun.

15. A method as in claim 11 wherein step (b) additionally includes the following substep performed for signals at the receive band frequencies:

(b.2) providing an open circuit by the single-ended filter to the input/output line.

16. A duplexer comprising:

an input/output line;

a transmit segment; connected to the input/output line; and,

a receive segment, the receive segment including:

a balun connected to the input/output line, the balun

including:

a first output, and

a second output, and

a differential filter connected to the first output and the second output, the differential filter shorting the first output and the second output at transmit band frequencies of the duplexer.

17. A duplexer as in claim 16 wherein at transmit band frequencies of the duplexer, the first output and the second output are each shorted to a reference voltage.

18. A duplexer as in claim 16 wherein at transmit band frequencies of the duplexer, the first output and the second output are shorted to each other.

19. A duplexer as in claim 16 wherein the transmit segment includes a single-ended filter wherein at receive band frequencies of the duplexer, an open circuit is presented by the single-ended filter to the input/output line.

20. A duplexer as in claim 16 wherein the balun additionally includes:

a first transmission line coupled between the input/output line and the first output; and,

a second transmission line coupled between the input/output line and the second output; and,

21. A duplexer as in claim 16 wherein the balun additionally includes:

a first transmission line coupled between the input/output line and the first output, a length of the first transmission line is chosen to cause a phase delay of approximately one fourth wave length at receive band frequencies of the duplexer; and,

a second transmission line coupled between the input/output line and the second output, a length of the second transmission line is chosen to cause a phase delay of approximately three fourths wave length at the receive band frequencies of the duplexer.

22. A duplexer as in claim 16 wherein the differential filter includes resonator elements connected so that at transmit band frequencies of the duplexer, the first output and the second output are shorted.

10. EVIDENCE APPENDIX

None

11. RELATED PROCEEDINGS APPENDIX

None.